APPENDIX 1

DATA BANK INDEX
OCTOBER 1981

DATA BANK INDEX

DEVELOPMENT PROPOSAL

DB. DP. 1 - Arena Stadium Study
DB. DP. 2 - Civic Square Urban Renewal Scheme
DB. DP. 3 - Historical Buildings
DB. DP. 4 - The Central Area Plan: Nov. 80
DB. DP. 5 - Jackson Square Redevelopment Plans
DB. DP. 6 - Staging of Residential Development in Hamilton
DB. DP. 7 - +15 Walkway Conceptual Plan
DB. DP. 8 - Limeridge Mall Site Plan & Traffic Analysis
DB. DP. 9 - Planning & Development Committee Applications
DB. DP. 10 - Land Ownership: Municipal
DB. DP. 11 - TH &B Property Plan (Standing File)
DB. DP. 12 - CNR Property Plan (Standing File)

DATA BANK INDEX

ENVIRONMENT

DB. EN. 1 - Climatic Conditions
DB. EN. 2 - Niagara Escarpment Scenic Drive Feasibility Study
DB. EN. 3 - Environmental Assessment Act
DB. EN. 4 - Proposed Plan For Niagara Escarpment
DB. EN. 5 - Hamilton Region Conservation Authority - Regulations
DB. EN. 6 - Sarnia to Montreal Interprov. Pipeline - Field Observ.
DB. EN. 7 - The Bruce Trail Guide Book, Twelvth Ed. 1980
DB. EN. 8 - Water Well Records

DATA BANK INDEX

FINANCIAL DATA

DB. FN. 1 - Capital Budgets, Region's Financial Report 1980-84
DB. FN. 2 - Capital Budgets, Region's Detailed Sheets 1980-84
DB. FN. 3 - Capital Budgets, Region's Current Budget 1980

DATA BANK INDEX

MTC STANDARDS & PUBLICATIONS

DB. M. 1 - See List DBS-10 to DBS-15 inc.
DB. M1.1 - Distance Table, Distance Table, King's, Secondary Hwys
DB. M1.2 - Compound Circular Curves and Spiral Curves Handbook
DB. M1.3 - Table for Ordinates of Vertical Curves - Imperial
DB. M1.3A - Vertical Curve Tables Ordinates of Parabolic Curves
DB. M1.4 - Form M-100, General Conditions of Contract
DB. M1.4A - Form M-314 Rev. July/76 - Tenders

DATA BANK INDEX

NEIGHBOURHOOD PLANS

DB. NP. 1 - Stinson, St. Clair & Blakely
DB. NP. 2 - Lansdale
DB. NP. 3 - Corktown
DB. NP. 4 - Durand
DB. NP. 5 - Beasley
DB. NP. 6 - Central
DB. NP. 7 - Bruleville
DB. NP. 8 - Gibson

DATA BANK INDEX

OFFICIAL PLANS

DB. OP. 1 - Official Plan for the City of Hamilton (DRAFT)
DB. OP. 2 - Official Plan for the Township of Glanbrook
DB. OP. 3 - Regional Municipality of Ham-Went.
DB. OP. 4 - Draft Official Plan for Hamilton Harbour

DATA BANK INDEX

POPULATION & EMPLOYMENT

DB. PE. 1 - Economic Base: Substudy of Regional Official Plan
DB. PE. 2 - Economic Base: Substudy of " " " " Inventory
DB. PE. 3 - Monitoring the Housing Market (Supply & Production)
DB. PE. 4 - 1979 Population Statistics by Neighbourhood
DB. PE. 5 - 1979 Accommodation Report: Elementary Schools
DB. PE. 6 - 1979 Accommodation Report: Separate Schools
DB. PE. 7 - An Action Plan for Economic Growth 1978

DATA BANK INDEX

OPERATIONAL ASPECTS

DB. OR. 1 - ICTS
DB. OR. 2 - Guideway

DATA BANK INDEX

PUBLIC PARTICIPATION

DB. PP. 1 - Methods for Citizen Involvement
DB. PP. 2 - Directory of Community Services: 1979-80
DB. PP. 3 - Citizens Organizations, Councils, Info., Services
DB. PP. 4 - Service Clubs in Hamilton-Wentworth, July '80.
DB. PP. 5 - Ethnic and Cultural Directory, April 1979.
DB. PP. 6 - Hamilton-Wentworth Directory & Buyers Guide
DB. PP. 7 - Community Techniques - Open Houses
DB. PP. 8 - Understanding Your Community by D.M. Connor
DB. PP. 9 - Citizen Participate! by D.M. Connor
DB. PP. 10 - Public Participation in Transportation Planning
DB. PP. 11 - Public Meetings on Selecting a Preferred Regional Development Pattern

DATA BANK INDEX

RAPID TRANSIT STUDIES

DB. RT. 1 - Report on Rapid Transit Hamilton Transit Planning 1969
DB. RT. 2 - Draft City of Hamilton Official Plan - Rapid Study 1970
DB. RT. 3 - Hamilton Rapid Study Physical Feasibility July, 1970
DB. RT. 4 - Strategy Study, Vols. 1 & 2 June, 1973, Vol. 1- Summary
DB. RT. 4A - Volume 2- Technical Information
DB. RT. 5 - Study of Existing Rights-of-ways for Intermediate Cap.
DB. RT. 6 - Recommended Priority Corridor within the Basic Trunk Networ
DB. RT. 6A - Interim Reports
DB. RT. 7 - Discussion of Potential ICTS Routes in Hamilton Nov.
DB. RT. 8 - UTDC URBAN DESIGN STUDY, Conclusions & Base Study
DB. RT. 9 - UTDC/ICTS URBAN DESIGN
DB. RT. 10 - ICTS URBAN DESIGN STUDY - CASE ONE/TWO
DB. RT. 10A
DB. RT. 11 - EDMONTON RAPID TRANSIT STUDY (4 REPORTS)
DB. RT. 12 - CALGARY RAPID TRANSIT STUDY (3 REPORTS)
DB. RT. 13 - Selection of MT. Corridor by Regional Council

DATA BANK INDEX

SOILS REPORT & DRAWING

DB. Sl. 1 - Buchanan Park
DB. Sl. 2 - Seismic Refraction Survey, Claremont Hill, Mountain Access Road
DB. Sl. 3 - Limeridge Road, Upper Wentworth St. includes Bore Hole Drawings
DB. Sl. 4 - Mountain Park Avenue
DB. Sl. 5 - Proposed Sewers Upper Wentworth St. & Mountain Park Ave.
DB. Sl. 6 - Geotechnical Profile proposed Hamilton Rapid Transit Route
DB. Sl. 7 - Inspection of Damaged Sewer Pipe - Ridge St.
DB. Sl. 8 - Foundation Conditions, Proposed Tennis Courts, Sackville Hill Park
DB. Sl. 9 - Proposed Watermain Installation Upper Wellington St., Limeridge Road & Stone Church Road
DB. Sl.10 - Test Pit Inspection, Proposed Housing Development West 5th Street
DB. Sl.11 - York Street, Bay to Dundurn Sts.
DB. Sl.12 - Proposed 42" Main; District #2, Markland St., Homewood Ave., Chedoke Ave., Studholme Rd., Highway 430
DB. Sl.13 - Claremont Hill Test Auger Holes - March 1968
DB. Sl.14 - West Ave. Storm Sewer, Apr. 69
DB. Sl.15 - CHARM Phase 1, Structure 1, borings for West Pier
DB. Sl.16A - CHARM Phase III - section drawings
DB. Sl.16B - CHARM Phase III - borehole logs
DB. Sl.16C - CHARM Phase III - Supporting Document
DB. Sl.17 - CHARM Phase III - Retaining Wall #9, borehole info.
DB. Sl.18 - CHARM Charlton Ave. Tunnel
DB. Sl.19 - CHARM Phase 1 - Pavement Performance Study, Sept.71
DB. Sl.20 - CHARM Phase 1 - Pavement Performance Study, Mar. '72
DB. Sl.21 - CHARM - St. Joseph's Dr. Project E.O. 67204, Nov.'72
DB. Sl.22 - CHARM - St. Joseph's Dr. Stability, Apr. '73
DB. Sl.23 - 42" ø Watermain on St. Joseph's Dr., Apr. '74
DB. Sl.24 - CHARM Project, Oct. '69
DB. Sl.25 - CHARM PHASE III - Hydrogeologic Report, May '70
DB. Sl.26 - Geotechnical Investigation Escarpment Accessibilty Study, May '80
DB. Sl.27 - Regional Soil Study, Jun '76
DB. Sl.28 - Seismic Monitoring of Blasting Operations CHARM Contract 3
DB. Sl.29 - Report on Corordinate Control Stations Industrial Dr. & CHARM Areas
DB. Sl.30 - Rock Anchor Tests for CHARM
DB. Sl.31 - Initial Blasting Operations for CHARMS
DB. Sl.32 - CHARM II soils investigation
DB. Sl.33 - CHARM II, Manhole 31
DB. Sl.34 - CHARM III - Background Monitoring Data (Slope Indicator Readings)

DATA BANK INDEX

TRANSIT STUDIES

DB. Tl. 1 - Hamilton Transit Study, June 1973, City & H.S.R.
DB. Tl. 1A - Hamilton Transit Study '73, Phase:1, Mar '72
DB. Tl. 2 - Dial-A-Bus 1974
DB. Tl. 3 - Hamilton-Wentworth Regional Transit Assumption Study Nov. 1974, Region & H.S.R.
DB. Tl. 4 - Transportation for Handicapped and Aged
DB. Tl. 4A - Project R.E.A.C.H. (Regional Enumeration & Census of the Handicapped).
DB. Tl. 5 - CUTA Policy on Transportation for the Handicapped
DB. Tl. 6 - Saltfleet Community Development: Final Report Public Transportation Feasibility Study
DB. Tl. 7 - Inter-Regional Bus Transit Study, Oakville - Hamilton
DB. Tl. 8 - Programmatic Research Approach to Transit Marketing
DB. Tl. 9 - HSR Maintenance & Storage Facilities Investigation
DB. Tl. 10 - Public Transit & Industry 1980. (Thesis Paper)
DB. Tl. 11 - 3rd Annual Report of HSR, 1979
DB. Tl. 12 - Ridership at peak load points
DB. Tl. 13 - HSR Bus Route Map & Schedules, includes Canada Coach
DB. Tl. 14 - Transit Studies, Origin-Destination Survey of Hamilton Mountain Corridor
DB. Tl. 15 - The Canadian Urban Transportation Industry
DB. Tl. 16 - Scarboro Town Centre Light Rail Transit

DATA BANK INDEX

TRAFFIC AND TRANSPORTATION STUDIES

DB. T2. 1 - Traffic Management Systems Study, Hamilton Traffic Dept.
DB. T2. 1A - Traffic Management Systems Study, Vol. 2
DB. T2. 2 - Feasibility Study of Lloyd D. Jackson Parking Garage Jan 1972
DB. T2. 3 - King Street Mall, 1972
DB. T2. 4 - Bikeways-Hamilton
DB. T2. 5 - Central Area Transportation Plan. 1978, on going Central Area Plan
DB. T2. 6 - Land Use and Transportation Study - Hwy 6, Glanbrook
DB. T2. 7 - Engineering and Route Feasibility Studies
DB. T2. 8 - Impact of Trans. on the CBD
DB. T2. 9 - Highways designated as snow emergency routes in the City of Hamilton
DB. T2. 10 - Hamilton Truck O.D. July '73
DB. T2. 11 - Traffic Control in Construction Areas - Manual
DB. T2. 12 - Design of Entranceways
DB. T2. 13 - Turning Movement counts within the Corridor
DB. T2. 14 - A.T.R. Counts of screenlines surrounding Corridor
DB. T2. 15 - Road Needs Study, County of Wentworth
DB. T2. 16 - Regional Road Study, Progress Report 2
DB. T2. 17 - City of Hamilton Road Needs Study
DB. T2. 18 - Parking Lots in the Downtown
DB. T2. 19 - City of Hamilton Street Inventory
DB. T2. 20 - Hamilton Central Area: Open Space, Urban Landscape and Pedestrian Traffic
DB. T2. 21 - East-West Artery Plans (Standing File)
DB. T2. 22 - Heavy Truck Routes (Plan) Hamilton
DB. T2. 23 - Travel Time Contours from Hamilton General Hospital

DATA BANK INDEX

TRANSPORTATION SUBSTUDIES OF THE REGIONAL OFFICIAL PLAN

DB. T3. 1 - Report 1 - Iventory, Oct '75, Regional Planning
DB. T3. 2 - Report 2 - Travel, Characteristics Survey, Oct '75.
DB. T3. 3 - Report 3 - Development of a Travel Forecasting Model Oct '76 Regional Planning Dept.
DB. T3. 4 - Report 4 - Transportation Impacts of Development Alternatives Oct '76 Regional Planning Dept.
DB. T3. 5 - Report 5 - External Travel Impacts Study
DB. T3. 6 - Substudy #6 of Official Plan: Transportation Capital Facilities Plan (draft version)

DATA BANK INDEX

UTILITY DATA

DB. Ul. 1 - Union Gas Detailed Drawings Showing Gas Mains within the Corridor
DB. Ul. 2 - UNION GAS: Gas Main Locations Showing Potential Planning Problems
DB. Ul. 3 - Traffic Signal Interconnect Locations
DB. Ul. 4 - 1979-1984 Storm Sewer Separation Program
DB. Ul. 5 - H.S.R. Overhead Feeder Cables
DB. Ul. 6 - CABLE TV: Mountain Cablevision
Hamilton Co-Axial
Western Co-Axial
Northgate Cable
Maclean Hunters
DB. Ul. 7 - Ontario Hydro
DB. Ul. 8 - Telecommunications
DB. Ul. 9 - T.H. & B. Railway Co. Aerial & Buried Plant
DB. Ul.10 - CNR Standard Clearance Diagrams

For Hamilton Hydro See DBL.4

DATA BANK INDEX

AERIAL PHOTOGRAPHS

DBL.1 - GRS00009-63,154 & 114
- GRS80009-62 - N. End of Corridor
- GRS80009-152- S. End of Corridor
- GRS80009-114-Centre of Corridor

DATA BANK INDEX

MAPS, PLANIMETRIC INDEX

DBL. 2 - White Prints & Reverse Sepias Sheet Nos.
7/11A, 7/11B, 7/11C, 7/11D, 7/12A, 7/12B, 7/12C, 7/12D,
8/11A, 8/11B, 8/11C, 8/11D, 8/12A, 8/12B, 8/12C, 8/12D
8/13B, 8/13C
9/11A, 9/11B, 9/11C, 9/11D, 9/12A, 9/12B, 9/12C, 9/12D
9/13B, 9/13C
10/11A, 10/11B, 10/11C, 10/11D, 10/12A, 10/12B, 10/12C
10/12D, 12/13C
White Prints & Reverse Sepias Sheet Nos.
7/11, 7/12, 8/11, 8/12, 8/13, 9/11, 9/12, 9/13, 10/11,
10/12, 10/13

APPENDIX 2

SUMMARY OF REPORTS AND STUDIES PREPARED FOR THE HAMILTON-WENTWORTH RAPID TRANSIT PRE-IMPLEMENTATION STUDY

SUMMARY OF REPORTS AND STUDIES PREPARED FOR THE HAMILTON-WENTWORTH RAPID TRANSIT PRE-IMPLEMENTATION STUDY

ENGINEERING

Generation of Feasible Alignments: Engineering

1980 - Cole Sherman and Associates Ltd.

Purpose From a review of geological, structural and utility data, in conjunction with the Planning Team, twelve alternative alignments for the rapid transit facility were to be identified with the elimination from further consideration of any alignments that are not feasible, viable or practical.

Recommendation Thirteen potential alignments were identified linking the Mountain to the Downtown core. For each of these thirteen alignments, a number of permutations and combinations existed, greatly expanding the total number of rapid transit routes.

Alignment Segments Analysis and Evaluation: Working Papers of Engineering Team

1981 - Cole Sherman and Associates Ltd.

Purpose To analyze the engineering aspects of each segment of feasible alignments, and to provide the results of this analysis to the Evaluation Team for the purpose of synthesizing the analysis for use by UTDC in selecting a recommended shortlist of the most promising alignment alternatives.

Approach

Analysis of alignments previously generated by Metro Canada Ltd. and the Planning Team, using existing information, and presentation of results to Evaluation Team. Assumptions were made on:

1. location of the guideway relative to the road allowances
2. that all alignment segments have a similar degree of difficulty
3. that intersections do not require individual study at this time
4. no consideration of station location
5. some consideration of property requirements
6. columns at intersections to be located so as to avoid conflicts with major utilities and services or cross streets
7. impacts of guideway on Limeridge Mall property is not considered
8. guideway to be located within the East-West Mountain arterial right-of-way without affecting existing services

Recommendation

The preferred segments were recommended for consideration by the Evaluation Team.

Detailing of Shortlisted Alternatives: Engineering

1981 - Cole Sherman and Associates Ltd.

Purpose

To analyze in greater detail the engineering component of the four shortlisted alternative alignments and provide the results of this analysis to the Evaluation Team for the purpose of synthesizing the analysis for use by UTDC in selecting a recommended alignment.

Approach — Using existing information, an analysis of the four shortlisted alignments was conducted, including several mini-analyses for the minor options to the four alignments. Assumptions were made on:

1. existing geotechnical data since the field program was deferred until after this study
2. the most suitable type of tunnel and foundation construction
3. that profiles will be set to provide a standard roadway clearance of 5 metres, except in the CBD where a minimum of 5.5 metres is required.

Recommendation — No recommendation.

Steel Alternative Guideway Study

1981 - Cole Sherman and Associates Ltd.
ABAM
Metro Canada Ltd.

Purpose — To investigate the feasibility of utilizing a composite steel guideway system, rather than a concrete guideway system, for the rapid transit system.

Recommendation — Steel is a viable and competitive material for the guideway system and should be considered in future tender bids.

Preliminary System Description of Recommended Alignments

1981 - Marshall Macklin Monaghan Limited/Hatch Associates
Cole Sherman and Associates Ltd.

Purpose — To prepare a preliminary functional plan in sufficient detail that a preliminary implementation plan can be specified, that capital and operating costs can be accurately estimated, that detailed design can follow and with a complete description of the integration with the urban and natural environment.

Recommendation

Rapid Transit Rationale: Interim Report

1980 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose — To review and document the basis for determining the corridor, purpose and implementation timing of the Hamilton-Wentworth Rapid Transit System.

Approach — A review of past studies and supporting documents and documentation of the transportation and urban planning rationale for corridor selection, corridor boundary, role of public transit and implementation timing.

Recommendation — For transportation, development and technological demonstration, implemenation of ICTS in the Mountain corridor can be supported. For transportation purposes, deferral of commencement of construction could occur until 1988-1992. However, to spur growth in the community and the promotion of Canadian technology, implementation could proceed immediately.

PLANNING

Generation of Feasible Alignments: Planning

1980 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose

From a review of the transportation and planning components of the Regional Municipality of Hamilton-Wentworth, in conjunction with the Engineering Team, twelve alternative alignments were to be identified for the rapid transit facility with the elimination from further consideration of any alignments that are not feasible, viable or practical.

Approach

Analysis of the transportation and urban planning components of each segment of the feasible alignments including:

1. definition of the differences between the options in terms of their abilities to serve the Mountain residents with the CBD as a travel destination
2. overview the sensitivity of the land uses along each route option to the application of ICTS

The assumptions varied with each route considered.

Recommendation

Thirteen potential alignments were identified linking the Mountain to the Downtown core. For each of these thirteen alignments, a number of permutations and combinations existed, greatly expanding the total number of rapid transit routes.

Alignment Segments Analysis and Evaluation:
Working Papers of Planning Team

1981 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose

To analyze the transportation and planning components of each segment of the feasible alignments, and to provide the results of this analysis to the Evaluation Team for the purpose of synthesizing the analysis for use by UTDC in selecting a recommended shortlist of the most promising alignment alternatives.

Approach

Analysis of the transportation and planning components of the feasible alignments, and presentation of the results to Evaluation Team. Assumptions were made on:

1. guideway would fit beside T.H.&B tracks
2. guideway would not be constructed over a major utility
3. evaluation of each option will be influenced by the construction of the guideway
4. the location of the Terminal Station
5. stations within high residential populations
6. location of maintenance yard
7. location of commuter parking areas
8. new stadium will be developed
9. the minimum desirable radius is 35 m (115 ft.) with a maximum column spacing of 22 m (72.5 ft.)
10. Columns would be located at the beginning and end of curves
11. the guideway could be cantilevered to either side and consecutive columns could be cantilevered on opposite sides

12. double guideways were considered in CBD-1, CBD-2 and CBD-3 to illustrate the worst condition. Single guideways are assumed in CBD-4 loop
13. the width of the double guideway is assumed to be 6.6 m (22 ft.) and the width of a single guideway is 3.6 m (12 ft.)
14. columns and bents are located in a manner that would minimize the road impacts
15. in some locations, a trade-off can be made on road or pedestrian impact
16. generally, street capacity would have priority over pedestrian impacts
17. exact station location was not considered in this analysis
18. integration with surface transit buses was not considered
19. minimum clearance between guideway and a building is 4 feet

Recommendation — The preferred segments were recommended for consideration by the Evaluation Team.

Detailing of Shortlisted Alternatives: Planning

1981 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose — To analyze in greater detail the transportation and planning components of the four shortlisted alternative alignments and provide the results of this analysis to the Evaluation Team for the purpose of synthesizing the analysis for use by UTDC in selecting a recommended alignment.

URBAN DOCUMENTATION CENTRE
RESEARCH UNIT FOR URBAN STUDIES
McMASTER UNIVERSITY
HAMILTON, ONTARIO

Recommendation — No recommendation.

Volume I	-	Technical Document
Volume II	-	Alignment Plans and Transportation Plans
Volume III	-	Land Use Plans, Urban Design Plans
Volume IV	-	HSR Bus Survey and DATA Analysis
Volume V	-	Sub-option Analysis

Hamilton Street Railway Transit Survey

1981 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose — To document the study procedure and analysis of the Origin-Destination Transit Survey undertaken on HSR Mountain bus routes in December of 1981.

Approach — A three part survey was carried out. An onboard questionnaire survey was distributed to passengers while boarding their bus. A count of boarding and departing passengers was made at each bus stop. Traffic flow, vehicle occupancy and vehicle classification counts were made on all Hamilton Mountain Access Routes for the purpose of identifying the p.m. peak traffic period and to determine traffic volumes as well as the transit model split during that time.

Recommendation — No recommendation.

Comparison of Alternative Modes

1981 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose — To demonstrate the ability of the ICTS technology to comply with the Hamilton-Wentworth Rapid Transit System requirements and to compare the performance characteristics of ICTS with those of other proven and available transit modes.

Recommendation

Social Impact Study

1981 - Marketing Decision Research

Purpose — To assess the social impact of the implementation of rapid transit upon the Region and, specifically, along the selected route corridor.

Recommendation

Final Impact Study

1981 - IBI Group

Purpose — To assess the financial impact upon the Region of implementing rapid transit.

Recommendation

ENVIRONMENTAL

Existing Corridor: Natural Environment

1980 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose — To prepare a description of the natural environmental conditions in the ICTS Study Corridor.

Approach — Using existing information, the environmental conditions and associated impacts were described for the route alignment alternatives. In addition to documenting the natural environment of various alignment alternatives, this report discusses to the full extent of the available data base, the potential environmental impacts associated with the proposed undertaking. Any special physical or biological feature considered unique to a particular alignment, or group of alignments is highlighted.

Recommendation — No recommendation.

Description of Impacts on the Natural Environment along Alignments W, X, Y and Z

1981 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose — To analyze in greater detail, the potential changes to the natural environment for each of the set of four shortlisted alternative alignments and to provide the results of this analysis to the Evaluation Team for the purpose of synthesizing the analysis for use by UTDC in selecting a recommended alignment.

Approach — The four route alignments selected by Metro Canada Limited were each segmentized for more detailed study in order to provide a more comprehensive information base concerning the location, type and magnitude of impacts, as well as possible mitigative requirements. This approach was also used to define discernible differences between alignments, to assist in the selection of a preferred alignment.

Recommendation — No recommendation.

Description of the Natural Environment Along the Route Alignment Alternatives

1981 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose — To analyze biophysical impacts of constructing ICTS on each segment of the feasible alignments and to provide the results of this analysis to the Evaluation Team for the purpose of synthesizing the analysis for use by UTDC in selecting a recommended shortlist of the most promising alignment alternatives.

Approach — Based on the initial planning, engineering and environmental reports, further consideration was given to a description of the natural environment and the impacts of the proposed undertaking for the 26 route alignments chosen, using existing information.

Recommendation — Relative impacts were identified for each segment.

Ambient Noise Survey: Environmental Team

1981 - Marshall Macklin Monaghan Limited/Hatch Associates

Purpose — The report describes three distinct aspects of the environment into which the noise from the system is to be introduced. These are the human response to noise, the legal framework of the process whereby the impact of noise on the community will be assessed and description of a measurement programme undertaken to characterize the acoustical environment in those areas most likely to be affected by noise from the system.

Approach — Using existing information, the terms used to define noise are explained as well as a description of how noise is measured. The effects of noise on people and the legal framework for assessing this are discussed. During a field study, two types of noise measurement programs were set up, one being overnight measurements and the other being one half hour short term measurement.

Recommendation — Only obeservations and measurements were taken.

Noise and Vibration Impact Study along Recommended Route

1981 - Wilson Ihrig Incorporated

Purpose — To analyze the existing noise and vibration levels along the recommended route, to assess the impact the rapid transit system has when constructed with suggested mitigative measures where required.

Recommendation

PUBLIC PARTICIPATION

Analysis of Public Comments: Initial Open House

1980 - Connors Development Services

Purpose — To analyze the public's initial reaction to the concept of elevated rapid transit for Hamilton-Wentworth, following a coupon survey and Open House in October 1980.

Recommendation — No recommendation.

Analysis of Public Comments and Ranking of Evaluation Factors

1981 - Connors Development Services

Purpose — To assist the Evaluation Team, the analysis of Open Houses held in January 1981 were documented on the public's reponse to the evaluation criteria, route preferences and overall project support.

Recommendation — The public's response stressed good service, preservation of the Escarpment and impact on traffic movement.

Analysis of Public Comments on Selected Alignments

1981 - Connors Development Services

Purpose — To document the analysis of the public's comments on the Selected Alignments from coupon circulation and Open House comments during March of 1981.

Recommendation The public's preference was for Route "W".

Analysis of Public Ranking of Selected Alignments

1981 - Connors Development Services

Purpose To document the public's preference toward the selected alignments following their review of the "Summary of Findings" report and information.

Recommendation The public's preference was for Route "W".

Summary of Public Participation Program

1981 - Beak Consultants

Purpose To assess the public participation program and summarize the findings.

Recommendation

EVALUATION

Goals and Objectives for the Rapid Transit System

1980 - M.M. Dillon Limited

Purpose To prepare a summary of system objectives for the Hamilton-Wentworth Rapid Transit System as the basis for alignment and system evaluation.

Recommendation No recommendation.

Evaluation Framework and Preliminary Criteria

1980 - M.M. Dillon Limited

Purpose — To prepare a report on the evaluation framework and preliminary criteria to be used in the initial and future evaluation of route alignment alternatives.

Approach — Refinement of the evaluation methods to be used in shortlisting alternatives. Documentation of the process by which the criteria for the comparative analysis of feasible alignments were selected from the preliminary list contained in the Evaluation Framework and Preliminary Criteria Report.

Recommendation — No recommendation.

Evaluation Methods and Criteria for Shortlisting Alignments

1981 - M.M. Dillon Limited

Purpose — To confirm the evaluation method and criteria for use in shortlisting the alignment segment alternatives to four distinct rapid transit routes.

Recommendation — No recommendation.

Recommended Alignments and Summary Evaluation

1981 - Metro Canada Limited

Purpose — To document the comparison of alternative alignment segments and recommend four rapid transit routes.

Recommendation — Following an intensive and extensive evaluation process, Routes W, X, Y and Z with a number of sub-options, were recommended for further detailed analysis and evaluation.

Evaluation Methods and Criteria for Recommended Alignment Selection

1981 - M.M. Dillion Limited

Purpose — To prepare a document on the evaluation method and criteria for use in selecting a recommended alignment from the shortlist of four alternatives, including the sub-options.

Recommendation — No recommendation.

Rapid Transit Study Route Choices: Summary of Findings

1981 - Metro Canada Limited

Purpose — To provide a summary document of the engineering, planning and environmental analysis of the four shortlisted alignments.

Recommendation — No recommendation.

Summary Evaluation of Rapid Transit Routes and Recommendation of Preferred Route

1981 - Metro Canada Limited

Purpose — To document the comparison of the four alignments to select a preferred alignment.

Recommendation — No recommendation.

APPENDIX 3

ROUTE CHARACTERISTICS OF ALTERNATIVES W, X, Y AND Z[40]

	W	X	Y	Z
NATURAL ENVIRONMENT				
• Mature trees removed (mainly lower city impact)	60	46	30	30
• Replaceable trees removed	50	85	50	70
• Significance of tree	larger native species at and immediately below escarpment	larger native species along St. Joseph's Rd.	Minor	Minor
• Replanting capability of area	Good around portal at escarpment	On mountain replanting must occur on private property along alignment due to loss of boulevard. In lower city, replanting is possible.		
CONSTRUCTION				
• Transportation Impacts				
o Diversions	Some traffic diverted to Up. Wellington St.	Some traffic diverted to Up. James St. & Up. Wentworth St.		
o Mountain	Up. James - centre-lane is already built and can be used	Up. Wellington - close down 2 centre lanes/traffic disruption (1400 - 1600 veh/hr)		
	Cut & cover closes two lanes north of Fennell Ave. (2000veh/hr.)	Jolley Cut - close two lanes		
o Lower City	Minor impacts to lower city	Impact when John St. realigned	TH & B/CNR will require special provisions Minor impacts to lower city	Minor impacts to lower city
• Pedestrian Flow	--Major pedestrian disruption is in CBD where common route exists----------			
• Homes-construction disruption to total units	503	671	343	366 plus First Place units
• Business construction disruption relative to total units	Up. James north of Fennell. Major impact dependent upon duration of road disruption	---Upper Wellington St. Business area impacted----------		
		John St. businesses are impacted	TH &B/CNR will require special provisions	0
Loss of on-site parking	Temporary loss of parking at Mt. Plaza	0	0	0
• Environmental	Temporary impacts on Escarpment face	Minor impacts to St. Joseph's R.O.W.	Minimal impacts	Minimal impacts
• Sensitive Uses	Some impact at St. Joseph's Hospital, but distance & activity at that area of hospital will minimize impact	Strong impact on medical activities along John St. corridor at St. Joseph's Hospital	0	0
COSTS:				
Capital	$111.1 M.	$113.4 M.	$117.2 M.	$125.2 M.
Operating	$3.4 M.	$3.3 M.	$3.3 M.	$3.4 M.
STAGING:				
• Temporary Terminus	Good terminus location due to availability of open space if parking garage required.	Terminal location may require removal/rebuild of Safeway to provide parking area. Dependant upon anticipated park 'n' ride trade.		
• Future Costs to Mall	$32.2 M.	$17.9 M.	$17.9 M.	$17.9 M.
• Future connections	Expansion occurs from loop	Expansion occurs from loop	Expansion occurs from loop	Good connection potential to North and East from King/ Wellington area plus expansion from loop capability to west

	W	X	Y	Z
PROXIMITY TO USES: (cont'd)				
Public Uses				
• Open Space	James St. stairs adjacent to alignment	0	0	0
• Overshadowing	15 homes/midwinter have temporary shadow impacts	85 homes midwinter have temporary shadow impacts. Commercial corridor from Brucedale to Queensdale is darkened due to guideway and proximity of buildings		
• Sensitivity of Uses	St. Charles Church	St. Joseph's Hospital St. Elizabeth Nursing Home Church of the Ascension	0	0
• Hist/Arch Significance	Augusta/Hughson	Church of the Ascension	0	0
Number of Dwelling Units & Sensitive Uses Close to Stations				
• Increase in activity due to buses (impact adj. homes)	Mountain is Commercial areas mainly. Lower city is not a major bus transfer point (0)	Area around stations is mainly residential on mountain. Lower city is not a major bus transfer point (approx. 30)	Area around stations both above & below mountain is mainly residential(approx. 30)	Area around stations o mountain is mainly residential,lower city is mainly commercial (approx. 30)
Impact on Local Streets				
• Use by buses	----------Collector & Arterial Roads are used----------			
• Parking at stations	some parking may occur on plazas if not provided for in station design especially at terminal	some parking may occur on sidestreet and regulatory signs may have to be posted.		
Integration with Streets				
• right of way widths	100' Up. James, 66' James, Hughson, Charlton	66' Up. Wall., John, St. Joseph's (varies)	66' Up. Wellington & TH &B R.O.W.	66' Up. Wellington 66' Wellington 66-48' King William
• building face to building face (minimum)	150', 210', 115'	120', 85', 140', 80'	120', 65', 180'	120', 65', 125', 75' &
• potential for future change in land uses along alignment to help integration	Good potential along Upper James St. corridor & Hughson St. corridor	Some potential along Upper Wellington St. north of Fennell Ave. Poor potential south of Fennell Ave. Some potential along John St.	Some potential along Upper Wellington St. north of Fennell Ave.; poor potential south of Fennell Ave. Little potential along TH &B	Some potential along Upper Wellington St. north of Fennell Ave. poor potential south of Fennell Ave. Good potential along CHARM, Wellington St. & King William.
OBSTRUCTION OF VIEWS				
• views of escarpment	At entrance to tunnel	enters escarpment in major transportation area where structures now exist		
• views along corridors	James St. corridor has minor impact	John Strort corridor has strong impact	----	----
• views of cultural/hist. uses	Hughson/Augusta area	John/Charlton area	----	----
• views from public areas	St. Joseph's Hospital	----	----	----
• length of view disrupted	Views can occur below guideway and between columns, blockage will be on individuals perception.			
DEVELOPMENT/REDEVELOPMENT AT STATIONS				
• Official Plan Goals	----	----	----	King/Wellington as growth node
• Zone	On Mountain, zoned commercial - some pot. for change. Limited opportunity at St. Joseph's area due to character of neighbourhood	Stable residential on Mt. Good opportunity at Inverness. Limited opportunity at St. Joseph's area due to existing development.	Stable residential on Mt. Good opportunity at Inverness. Limited opportunity at Young St. due to TH&B	Stable residential on Mt. Good Opportunity at Inverness. Good opportunity at King/ Wellington due to growth node desire
• Community impact if redevelopment occurs where opportunities are good.	Low impact	Some impact	Some impact	Some impact
• Land availability for development	Little land available	Little land available	Land available along TH &B	Good land availability at King/Wellington

	W	X	Y	Z
PEDESTRIAN INTERFACE:				
Movement				
• sidewalk narrowing	No sidewalks need be removed	-----Commercial activity on Upper Wellington will be---------- impacted due to sidewalk narrowing between Queensdale/ Brucedale		
PROPERTY ACCESS:				
Residential				
• Left turns restricted at homes/apartment units	42 houses/62 apt. units(104)	148 houses/30 apt. units(178)	148 houses/30 apt. units (178)	148 houses/30 apt. units (178)
Commercial				
• Left turns restricted	(Up. James: South-bound Richwill) 6 commercial units	---(Upper Wellington: Brucedale to Queensdale)--- 49 commercial units	49 commercial units	49 commercial units
• Importance of Access	Important (Hwy. Comm)	---Mainly Neighbourhood Comm. use + Municipal Parking Lots-------- on both sides of street		
Public				
• Emergency uses impacted by access restrictions	0	0	0	0
PARKING:				
• On street removed	9	0	0	0
• Business Impact	Professional Offices	0	0	0
• Alternate Parking Available	Yes, in adjacent parking lots	0	0	0
DISPLACED USES:				
Housing				
• Apartment Units	0	3 units at Inverness Station	3 units at Inverness Station	3 units at Inverness Station + 15 rooming house units at Main/Wellington
• Single Family (depend on owner option)	0	5 - John St. Station 1 - Mohawk Station	1 - Mohawk Station	1 - Mohawk Station
Commercial				
• Business Units	1	14	14	15
• Off Street Parking	380 spaces at Mountain Plaza	----	---- Dependent upon R.O.W. uses from THAB & CNR	Some off street parking space areas along King William and Wellington for column placement. Minor impact
• Railway				
Public Uses				
• Buildings	0	Ontario School	Ontario School	Ontario School
• Open Space	Niagara Escarpment at tunnel portal, St. Joseph's Hospital parkette	Parkette at Fennell Ave.	Parkette at Fennell Ave.	Parkette at Fennell Ave.
• Potential for Replacement	stairs can be re-located	-- Parkette can be redesigned into station. ---		
• Historical Buildings	0	0	0	0
PROXIMITY TO USES:				
Residential				
• Total Houses along Alignment	53	181	166	169
• Total houses at Portal	12	7	7	7
Dwelling Units				
• Potential for Privacy Impact (1½ - 3 storey units at 100')	57	168 (includes 64 medical beds)	72	96
Office and Commercial Frontage				
• Potential for Privacy Impact (2nd/3rd storey at 100')	4050'	3810'	3090'	4450'

TRANSPORTATION:	W	X	Y	Z
TRAVEL TIME MacNab St. Station to Mohawk Station	6 min/31 sec minimum	6 min/38 sec minimum	6 min/50 sec minimum	8 min/15 sec minimum
Rapid Transit Ridership: 1986/2001 Yearly	8,250,000/18,879,000	8,487,000/20,106,000	8,400,000/19,566,000	8,250,000/19,881,000
Potential to Attract More Riders				
1) Population around stations to reflect walk-in potential differences	3,900	5,600	5,700	6,100
2) Major Activity Centres served	St. Joseph's Hosp. 2 mountain stations	St. Joseph's Hosp. At Inverness Sta.	At Inverness Station At lower city station	At Inverness station At lower city station
3) Redevelopment Potential to increase rapid transit useage				
4) Major office employment at lower city station	380	0	0	112
Ancillary Facilities:				
• bus loops • kiss 'n' ride	(where required,) bus loops can be provided at all station sites can be provided at all -- kiss'n' ride problems at Wellington/Mohawk station -- sites			
• emergency & maintenance road	yes (James Mt. Rd. to portal)	YES (St. Joe's R.O.W. CHARM TO PORTAL	YES (along TH&B) CHARM TO PORTAL	YES (CHARM to Portal)
• site layout difficulties for maintenance yard	SOME (Have to cross maintenance yards)	SOME (Have to cross maintenance yards)	NO (Parallels maintenance yards)	NO (Parallels maintenanc
SURFACE TRANSIT INTERFACE:				
Passenger Convenience				
• non-CBD connections	Service to St. Joe's plus James St. corridor. Industrial Express from CBD	Service to St. Joe's. Industrial Express from CBD	Industrial express connection at Young St. saves 2 minutes more than W&X.	5 min less travel time for east lower city to mountain transfers (50% of all bus transfers). Excellent opportunity for industrial express services; saves 5 min.
• extra travel time	Transit riders are now oriented toward the East Mountain at a 2:1 ratio. Therefore, closer rapid transit is to east mountain, better service is provided. Estimated 2 minute extra travel time as compared to X,Y,Z	Transit users to west must be re-routed one major block (2 Min.) out of way (Downtown). This now occurs due to bus orientation.		
Bus System				
• feeder bus miles	18996 mi.	18456 mi.	18456 mi.	18456 mi.
• service area	Immediate benefit to 5,000 people to S.W.	Long range benefit to new population of 30,000 planned to Southeast (travel time saving)		
• bus miles on escarpment	Concession St. to CBD bus route must remain	All buses removed from escarpment	Inverness station to St. Joe's bus route must be put in service	Inverness station to St. Joe's bus route must be put in service
• express service option	Good potential to Mohawk College. CBD to industrial area	Some potential to Mohawk College. CBD to industrial area	Some potential to Mohawk College. Young to industrial provides good opportunities	Good to Mohawk College due to transfer movement. Wellington to Industrial provides excellent opportunities
ROAD INTERFACE:				
Capacity				
• Length of Pavement narrowed	No significant reduction in road traffic envisioned. Where rapid transit intrudes on roadway, traffic lane are reconstructed to satisfy road needs			
Side Street Access				
• Restrictions	right turns only at Southbend/Upper James	-----Right turns only at Norris, Dean, McElroy, Brucedale-------		
• Number of Homes Impacted	28	331	331	331

APPENDIX 4

POTENTIAL IMPACTS OF ICTS TO ROADS AND TRAFFIC ALONG THE PROPOSED ICTS ALIGNMENT[42]

Segment: Upper James Street

° Richwill Road to McElroy Road

- R.O.W. 100'
- Pavement - 62'
- E/S and W/S
  - 5' boulevard
  - 5' CW
  - 8.6' CW to PL
- pavement widens south of McElroy Road

° McElroy Road to Wembley Road

- R.O.W. 103.5'
- pavement 74'
- E/S 7' CWC
- W/S
  - 5' boulevard
  - 5' CW
  - 11' CW to PL

- Guideway Location
  - guideway will be located in a centre median

- Impact
  - left turns at driveways on Upper James from Richwill Drive to just north of McElroy will be restricted
  - left turns from Upper James to Richwill Drive would be permitted. Right and left turns from Richwill Drive to Upper James will be permitted
  - left turns from Upper James to South Bend Road would be prohibited
  - turns from South Bend Road to Upper James would be restricted to right turns only
  - road capacity and existing number of lanes would be retained within the existing curb to curb width
  - left turns at McElroy will have to occur with a separate phase built into the traffic signal

° Lower City Segments

Segment: James Street

° at Markland Street

- 66' R.O.W.
- pavement 39'3"
- 5'5" boulevard E/S
- 8'5" CW E/S (1)
- 5'5" CWC W/S (2)
- columns to be placed in east boulevard

° St. Joseph's Drive to Herkimer Street

- 66' R.O.W.
- 39'9" pavement
- 4'4" boulevard E/S
- 7'9" CW E/S
- 5'5" CW W/S

- Guideway Location

  - the guideway will be placed in the east boulevard angling across to the intersection of Charlton Street and Hughson Street

- Impact

  - the road capacity will be retained

Segment: Hughson Street

° Charlton to Forest

- 66' R.O.W.
- 30' pavement
- 5'6" CWC W/S
- 5'6" CWC E/S

° Forest Street to Young Street

- 66' R.O.W.
- 30' pavement
- 5'6" CWC E/S and W/S

° Young to Augusta

- 66' R.O.W.
- 30' pavement
- 5'6" CSC E/S and W/S

° Augusta to Haymarket

- 39' R.O.W.
- 24' pavement
- 7' CWC E/S and W/S

- Guideway Location

- the guideway columns between Charlton and Augusta will be placed in the pavement along the west curb
- the guideway will angle east at Augusta and then north to the T.H.&B. through the parking areas as shown on Plan 8130-HA-104

- Impact

- the roadway would be changed to two 11 foot lanes and an 8 foot parking lane between columns. This would necessitate the shifting of the on-street parking from the east side to the west side of the street between Charlton and Young. Parking would be permitted between columns, however, a reduction in the number of parking spaces from 14 to 9 would result

- The permissible column spacing would ensure access to all intersecting roads, although visibility may be limited at intersections for cross-street traffic. This would not create serious problems since there are now stop signs on Hughson Street at each intersection except at Forest where the existing stop control would be reversed.

The placement of the guideway along the west curb would mean that all on-street parking would be located on the west side between the columns. Because of the column spacing and consideration of existing driveways, the number of parking spaces would be reduced as shown in Table 1.

Table 1

On-Street Parking

Hughson Street		Present	With ICTS
Charlton to Forest	E/S	6 spaces	4
Forest to Young	E/S	8 spaces	5
Young to Augusta	W/S	8 spaces	6
Augusta to Haymarket	E/S	5 spaces	3
	Total:	27 spaces	18 spaces

Presently, there are 5 parking spaces on the east side of the street between Young Street and Augusta Street and 5 spaces between Augusta Street and Beckley Street. These spaces will be relocated to the west side between the guideway column.

° CBD Loop Segments

Segment: T.H.&B. R.O.W.

° MacNab Street to Catharine

- Guideway Location

  - guideway will be placed within the T.H.&B. R.O.W. as shown on Plan 8130-HA-104

- Impact

  - the guideway would have no impact on adjacent roadways

Segment: Catharine Street

° Hunter to Main

  - 40' R.O.W.
  - 20-24' Pavement, one way S/B
  - 5'-6' CW E/S and W/S
  - columns to be placed on the west side along the property line

° Main to King

  - 39'9" R.O.W.
  - Pavement 29'9" to 33'8", one way S/B
  - 5' CWC W/S

- Guideway Location

  - guideway and columns would be placed on W/S on property outside the existing road allowance

- Impact

  - the existing number of lanes and road capacity will be retained

Segment: Catharine Street

- King Street to King William Street

  - 45' R.O.W.
  - 30' Pavement, one way S/B
  - 8' CW W/S
  - 6.5' CW E/S

- Guideway Location

  - the guideway will turn from the west side of the roadway to the east to permit the turn west onto King William Street

- Impact

  - cantilevers will be used to support the guideway with no reduction in pavement width

Segment: King William Street

- Catharine Street to John Street

  - 48' R.O.W.
  - CW 10' N/S and S/S
  - 28' Pavement, one way E/B, 2 lanes

- John Street to James Street

  - 48' R.O.W.
  - 30' Pavement, one way E/B, 2 lanes
  - 8'-10' CW N/S and S/S

- Guideway Location

  - the guideway is to be located along the north side of the roadway between Catharine Street and John Street to facilitate a planned station. Between John Street and James Street, the guideway will be located on the south side of the roadway 18 ft. north of the south property line

- Impact

  - the pavement will be reduced but two traffic lanes will be maintained
  - the on-street parking presently along the north side of the street cannot be moved between the columns on the south side because of the numerous driveways on the south side, and hence most on-street parking would be eliminated
  - visibility at intersecting streets would be affected. However, where traffic signals are installed, the problem caused by this visibility constraint is removed. At Hughson Street, where traffic signals do not now exist, a reversal of the stop condition (stop sign) to King William Street from Hughson Street should resolve the visibility problem.

Segment: James Street

° King William Street to King Street

  - 80' R.O.W.
  - 53' Pavement, one way S/B
  - 12' CW E/S and W/S

- Guideway Location

  - the guideway would be located in the west sidewalk 11 feet east of the west property line

- Impact

  - the number of lanes and road capacity will normally be retained, however, to negotiate the turn at King William onto James, the sidewalk will be narrowed due to column placement.

Segment: King Street

° James Street to MacNab Street

  - 57' Pavement, one way W/B
  - 12'6" CWC N/S and S/S

- Guideway Location

  - the guideway would be located over the north sidewalk between James Street and MacNab Street, 11 feet south of the north property line

- Impact

  - the pavement width and number of lanes would be retained
  - visibility would not be affected since the intersections are presently signalized

Segment: MacNab Street

° King Street to Main Street

  - 24' roadway E/S and W/S of centre bus island
  - 17.75' median bus island

- Guideway Location

  - guideway columns would be located in a widened median. The widening would occur to the west.

- Impact

  - one of the three northbound traffic lanes would be eliminated
  - the southbound lanes could be restricted to buses only to provide suitable interface between the ICTS station and the surface buses without interference from vehicles

Segment: Whitehern Loop

° Main Street to T.H.&B.

- Guideway Location

  - placed outside of R.O.W. around Whitehern Place to T.H.&B.

- Impact

  - the road capacity and the number of lanes on the adjacent streets would be retained

i) Road Capacity

° In general, the alignment follows the road allowance of major roads and has been located to maintain the existing number of basic lanes.

° There will be some pavement narrowing on sections of Hughson and King William where only parking will be affected.

° Other than the effect of guideway columns on MacNab Street, there will be little or no impact on arterial road capacity.

ii) Left Turn Prohibitions

- Left turn restrictions will only occur along a three block section of Upper James Street where a centre median will be created

  - left turns from the arterial road can occur only where a left turn lane is provided in the 20 foot median. This can be done with cantilevered guideway columns.
  - left turns onto the arterial road can be permitted only where traffic control signals are installed.
  - left turns will be restricted from driveways.
  - right turns will only be permitted at Southbend Road.

iii) Traffic Control

- Reduced visibility due to guideway location will have an impact at two minor intersections in the downtown area where the reversal of stop sign control will be necessary. This includes Charlton at Forest and Hughson at King William. Additional locations may be identified at the detailed design stage.

iv) Parking

- The parking supply will be reduced by nine spaces on Hughson Street on the W alignment.

- Most of the parking spaces on King William Street between James and John will be eliminated.

v) Boulevard Width

- Boulevard width will remain equal to or greater than existing in most locations.

APPENDIX 5

CONSTRUCTION IMPACTS
ON
EXISTING SERVICES AND UTILITIES[43]

APPENDIX

IMPACTS ON EXISTING SERVICES AND UTILITIES

Street	Road Reconstruction, Utility and Service Relocations	Major Disruptions due to Utility and Service Relocations
- Station at Upper James	° Bury hydro cables on Mohawk Road ° Relocate hydro ducts on Upper James ° Relocate 2 hydro poles on Upper James ° Relocate street lights ° Relocate 8" dia. gasmain ° Restoration	Short but significant disruptions to hydro and gas services
UPPER JAMES STREET		
- Richwill Road to South Portal FIG. 3.54	° Relocate hydro ducts and 8" dia. gas main ° Temporary works and restoration	Short but possibly significant interruption to gas and hydro services

Street	Road Reconstruction, Utility and Service Relocations	Major Disruptions due to Utility and Service Relocations
- Portal and Station at Fennell Avenue	° Move access to Mall parking lot south to avoid conflict with Portal	
	° Relocate 36" dia. and 12" dia. watermains	Access to Fire Hall and gas station restricted during sewer and watermain construction
	° Relocate hydro poles	
	° Construct new 12" dia. sewer	
	° Remove and reinstate portions of Upper James Street and Fennell Avenue	
	° Temporary works and restoration	
		2
JAMES STREET SOUTH		
- North Portal	° Replace 700 ft. of 4'x4' box sewer with 60" dia. pipe	
	° Reconstruct stairway up escarpment	
	° Restoration	
- St. James Place to Charlton Avenue including Station	° Restoration	

Street	Road Reconstruction, Utility and Service Relocations	Major Disruptions due to Utility and Service Relocations
HUGHSON STREET		
- Charlton Avenue to Augusta Street FIG. 3.55	° Relocate Bell Telephone ducts ° Relocate street lights ° Relocate 4" dia. gasmain ° Relocate hydro poles to east side ° Restoration	
- Augusta Street to Haymarket Street	° Restoration	
TH&B RAILWAY		
- Hughson Street to Catharine Street	° Restoration	

Street	Road Reconstruction, Utility and Service Relocations	Major Disruptions due to Utility and Service Relocations
CATHARINE STREET		
- T.H. & B. Railway to King Street	° Relocate Bell ducts on Hunter Street ° Relocate hydro ducts on Hunter Street and King Street ° Dismantle and re-erect trolley bus cables on King Street and Main Street ° Restoration	Short but significant interruptions to Bell service Cannon trolley buses must be short-turned at Wellington during construction of guideway across King Street
- King Street to King William Street	° Relocate 24" dia. watermain ° Relocate 8" dia. gasmain ° Relocate hydro ducts on King William Street ° Restoration	Traffic will be restricted to one lane during watermain and gasmain relocation Short but possibly significant disruptions to hydro and gas service
KING WILLIAM STREET		
- Catharine Street to John Street	° Relocate hydro and street light duct banks ° Relocate street lights ° Restoration	Duct banks - major power supply to downtown area. Relocation may result in significant disruptions to service during relocation

Street	Road Reconstruction, Utility and Service Relocations	Major Disruptions due to Utility and Service Relocations
- John Street to James Street FIG. 3.56	° Relocate 6" dia. watermain	Traffic will be restricted to one lane during utility relocations
	° Relocate 8" dia. L.P. gasmain	
	° Relocate Bell duct	
	° Dismantle and re-erect trolley bus cables on Hughson Street	Barton trolley buses must be short-turned at Robert Street during guideway construction across Hughson Street
	° Restoration	
JAMES STREET		
- King William Street to King Street	° Dismantle and re-erect trolley bus lines on James Street	Barton trolley buses must short-turn at Robert Street during guideway construction
	° Relocate street lights	
	° Relocate Bell and hydro ducts	Short but significant disruptions to Bell service
	° Relocate traffic lights at King Street and King William Street	
	° Temporary works and restoration	

Street	Road Reconstruction, Utility and Service Relocations	Major Disruptions due to Utility and Service Relocations
KING STREET		
- James Street to MacNab Street FIG. 3.57	° Relocate street lights	
	° Relocate traffic signals at MacNab Street intersection	
	° Relocate trolley bus cables on King Street	Trolley buses on King Street must short-turn during construction
	° Relocate hydro and Bell ducts	
	° Relocate hydro manhole	Short but significant disruptions to hydro and Bell supply to Downtown businesses
	° Restoration	
MACNAB STREET		
- King Street to Main Street FIG. 3.58	° Relocate 6" dia. watermain	
	° Relocate 4" dia. gasmains at King Street and Main Street	
	° Relocate traffic signals at Main Street and King Street	
	° Relocate trolley bus cables on MacNab Street	Trolley buses on MacNab Street and Main Street will be short-turned during construction
	° Relocate street lights	
	° Temporary works and restoration	

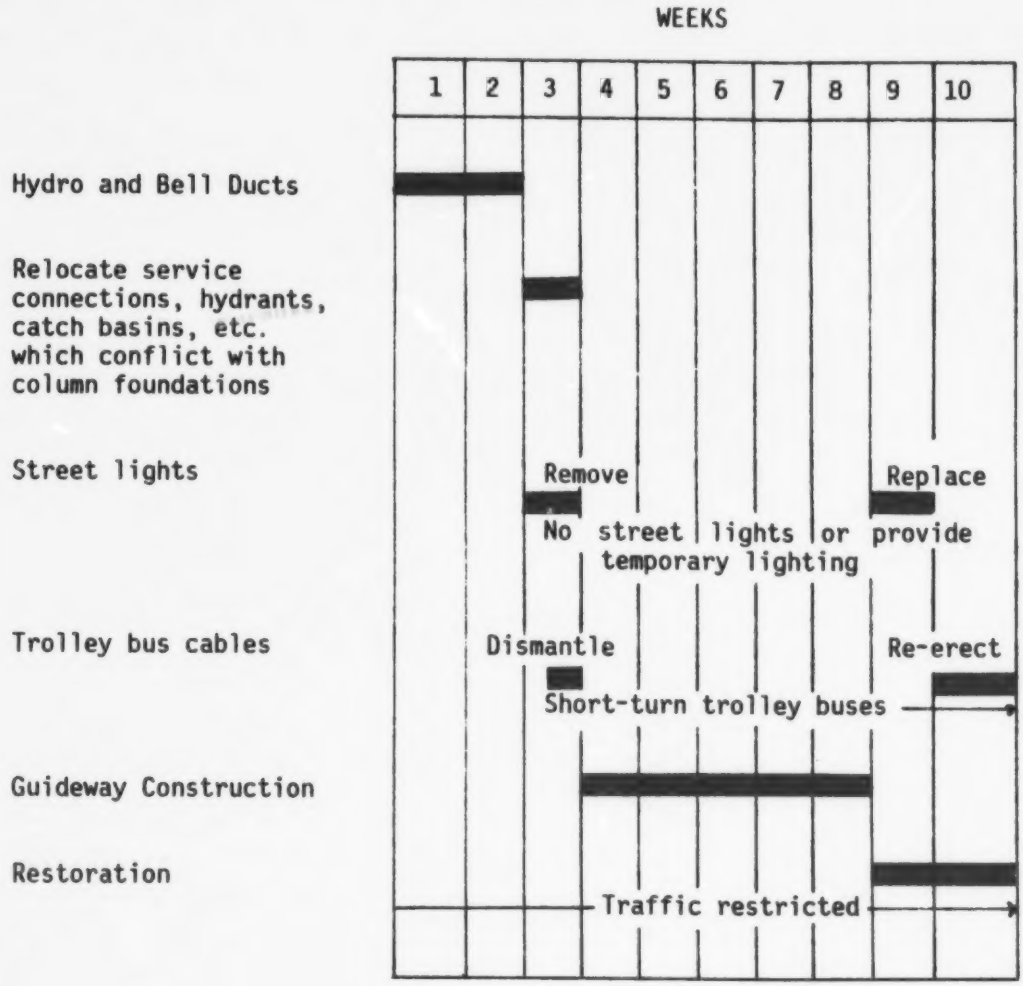
Street	Road Reconstruction, Utility and Service Relocations	Major Disruptions due to Utility and Service Relocations
- Main Street to Jackson Street	° Relocate Bell duct ° Relocate street lights ° Restoration	
CITY HALL PARKING LOT		
- Jackson Street to T.H. & B. Railway	° Restoration	
TH&B RAILWAY		
- MacNab Street to Hughson Street	° Relocate signal cable and drainage where necessary ° Restoration	

In order to keep interruptions to service to a minimum, most service and utility relocations and road widenings will be carried out prior to guideway construction. The length of time required to carry out these works will depend largely on co-ordination. If all relocations and road works were to be carried out by one general contractor, work on the various service utilities could be carried out concurrently. However, if the agencies controlling them wish to carry out the work using their own forces or contract out the works themselves, then the time required to complete all relocations will be lengthened considerably. Disruptions to traffic and access will similarly be increased, as will restoration costs due to duplication.

Where extensive road works and relocations are required, considerable lead time will be required. This work would have to be completed prior to guideway construction to avoid restricting traffic too severely.

The chart on the following page is an example of how relocations could be scheduled for one section of guideway approximately 400 ft. in length, in this case on King Street from James Street to MacNab Street. Relocation work would follow a similar pattern for other sections of guideway.

KING STREET - James Street to MacNab Street



APPENDIX 6

CONSTRUCTION IMPACTS - TRANSPORTATION FACTORS[44]

IMPACTS OF CONSTRUCTION - TRANSPORTATION FACTORS

The construction impacts will be discussed related to the following transportation factors:

- Road System
- Surface Transit
- Access to Adjacent Properties

Mountain Segments

Segment: Upper James Street - Richwill Road to Wembley Road

- A centre median would be constructed in the existing centre two way left turn lane. The guideway would be located in the median.

Impact:

- Road System

  During construction of the median, the number of lanes in each direction would be affected and exclusive turning lanes at intersections may be eliminated for short periods of time. During the peak daily periods, it would be desirable to maintain two lanes to accommodate the traffic volumes. Otherwise, considerable congestion will occur with diversion to other routes. After the completion of the median, the impact of constructing the guideway would be less severe. The number of lanes would be maintained to accommodate the peak period traffic volumes.

- Surface Transit

  Bus service would be retained on Upper James, however, construction may cause some congestion at times affecting the bus schedule.

- Access to Adjacent Properties

  Since construction would take place in the median, access to residences and businesses would be retained to the same extent as in the final condition.

Segment: Upper James - Fennell Avenue to Genesee Avenue

The cut and fill construction for the underground segment is detailed by the Engineering Team.

Impact:

- Road System

  It is likely that there would be periods when traffic would not be allowed on this segment of Upper James Street. Traffic would be diverted to either West 5th Street or Upper Wellington Street to the CBD or back to Upper James via Brucedale Avenue. This would result in out-of-way travel and the rerouting of trucks onto residential streets. This would not only contribute to road congestion but also impact on abutting properties from increased volumes of vehicular and truck traffic.

- Surface Transit

  The Upper James bus and the rush hour Upper James/Claremont bus both use this segment of Upper James. During the cut and cover construction, bus service would not be possible, however, both buses could be rerouted via Brucedale Avenue.

- Access to Adjacent Properties

  This section of Upper James is mainly commercial and hence, the closing of the street would have a severe impact on the businesses. Pedestrian traffic would, however, likely be permitted.

Lower Escarpment Segments

Segment: James Street - Tunnel Portal to Charlton Avenue

The guideway is to be located in the east boulevard.

Impact:

- Road System

  South of St. Joseph's Drive, the disruption to traffic would be minimal since the pavement width is adequate to accommodate the traffic volumes with a reduction of one northbound lane. There may be some congestion at peak times at the Markland intersection, which can be alleviated by shifting of a temporary centreline to provide a left turn lane.

  North of St. Joseph's Drive, the roadway would be reduced by one lane for column construction, however, the disruption would be for a short period of time only.

- Surface Transit

  All Mountain routes via the Jolley Cut use James Street. Column construction would have an impact on the schedules, however, no rerouting would be necessary.

- Access to Adjacent Properties

  Access to abutting properties would be maintained.

Segment: Hughson Street

- Charlton to Haymarket

The guideway is to be located in the west boulevard to Augusta and then turning east and then north to the TH&B R.O.W.

Impact:

° Road System

The roadway would be reduced from three lanes to two lanes, however, parking is permitted on one side. During construction, the parking would be prohibited and traffic in both directions would be allowed. Hence, the impact would not be severe.

° Surface Transit

None.

° Access to Adjacent Properties

Access would be maintained during construction.

CBD Segments

Segment: TH&B R.O.W. - Whitehern to Catharine

The guideway would be located with the railway R.O.W. causing no disruption to roadways, surface transit or access to residences and businesses.

Segment: Catharine Street - TH&B to King William

Between the TH&B R.O.W. and King Street, the guideway would be located west of the roadway on private property. Between King Street and King William Street, the guideway swings from the west side to the east side of the roadway in order to negotiate the turn west on to King William Street.

Impact:

- Road System

During construction, one lane of the roadway would be closed. This would create some congestion, however, traffic could easily be diverted to adjacent streets with no serious consequences.

- Surface Transit

No impact on surface transit.

- Access to Adjacent Properties

Access will be maintained during construction.

Segment: King William Street - Catharine Street to James Street

The guideway would be located on the north side of the street between Catharine and John and on the south side between John and James.

Impact:

- Road System

The roadway would be reduced from three lanes to two during construction. Traffic movement would be permitted, however, one parking would be eliminated.

- Surface Transit

  No routes on King William.

- Access to Adjacent Properties

  Access to businesses along King William would be maintained.

Segment: James Street - King William to King

The guideway turns from the south side of King William to the west side of James Street. Disruption would occur due to the guideway crossing of James Street and column construction.

Impact:

- Road System

  Disruption would occur during guideway construction by the closure of one lane, however, only for a short period of time. To avoid serious congestion, traffic could be rerouted to nearby streets.

- Surface Transit

  Some disruption would occur to the service and scheduling of buses on James Street, however, the present routing should be maintained. There may be disruption to the trolley coach overhead wires. It may be necessary to short turn trolleys for a short time and provide diesel shuttle service in the CBD.

- Access to Adjacent Properties

  Access would be maintained.

Segment: King Street - James Street to MacNab Street

The guideway would be located over the north sidewalk and then turning south on to the median on MacNab Street.

Impact:

° Road System

The north lane would be closed during the guideway construction creating some traffic congestion on King Street. Traffic could be rerouted onto nearby streets to reduce the congestion.

° Surface Transit

Surface transit and trolley routes would be maintained on King Street, however, due to the reduced number of lanes, disruption to service and scheduling would occur. Trolley wires may be temporarily removed requiring short turning trolley routes.

° Access to Adjacent Properties

Access would be maintained to abutting properties.

Segment: MacNab Street - King Street to Main Street

The guideway would be located over the existing median.

Impact:

° Road System

The roadway would be reduced from two lanes to one lane in each direction. However, the volume of traffic is low and hence, the impact would not be severe. Diversion of traffic to nearby streets would be possible.

° Surface Transit

During construction of the station and guideway, the trolley and diesel buses would be rerouted onto James Street between King and Main. Northbound buses could use MacNab and a temporary bus stop would be located on the north side of King Street west of MacNab.

° Access to Adjacent Properties

Access would be maintained to serve adjacent properties.

Segment: Whitehern Loop - Main Street around Whitehern to the TH&B R.O.W.

The guideway would turn eastward, south of Main over the Football Hall of Fame, around the Whitehern property to the TH&B R.O.W.

Impact:

There would be little impact on roadways, surfact transit and access to adjacent properties.

APPENDIX 7

AIR QUALITY IMPACTS
AMBIENT DISPERSION ASSUMPTIONS(45)

AIR QUALITY IMPACTS
AMBIENT DISPERSION ASSUMPTIONS

This appendix outlines the ambient dispersion assumptions used to estimate the relative impacts on nearby residences resulting from the emissions from construction activities.

For a ground level release from a non-buoyant point source, the downwind centreline concentration is:

$$X = \frac{Q}{\pi \sigma_y \sigma_z u}$$

Where:
- X = ground level concentration (g/m^3)
- Q = source strength (g/s)
- π = 3.1416
- σ_y = horizontal dispersion coefficient (m)
- σ_z = vertical dispersion coefficient (m)
- u = wind speed (m/s)

To determine relative ground level concentrations at a distance X downwind from the source, it has been assumed that:

- The area of construction activity is a circle with a diameter of 6 metres.
- The construction activity is a point source with an initial horizontal dispersion equal to the diameter of the construction activity.
- The vertical dispersion coefficient does not vary with X.
- At the construction site X = 1.

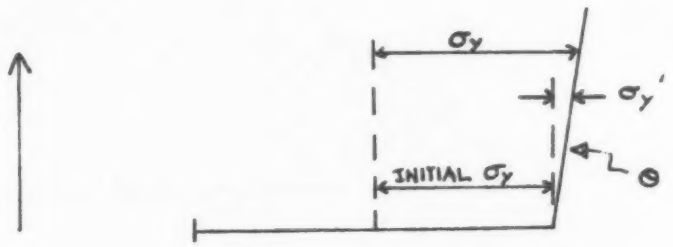
Because Q, π, σ_z and u are constant with X:

$$X = \frac{K}{\sigma_y}$$

Where: K = constant

σ_y = initial σ_y + σ_y',

initial σ_y = 1/2 length of construction activity



Length of construction activity

Since at the source X = 1 and $\sigma_y' = 0$

$$I = \frac{K}{\text{initial } \sigma_y}$$

K = initial σ_y = 1/2 length of construction activity = 3

And, at any distance X downwind:

$$X = \frac{3}{3 + \sigma_y}$$

To determine σ_y' use McElroy - Pooler dispersion coefficients (based on a series of experiments studying the dispersion of ground level releases in St. Louis).

For atmospheric stability, category 'D' (Pasquill):

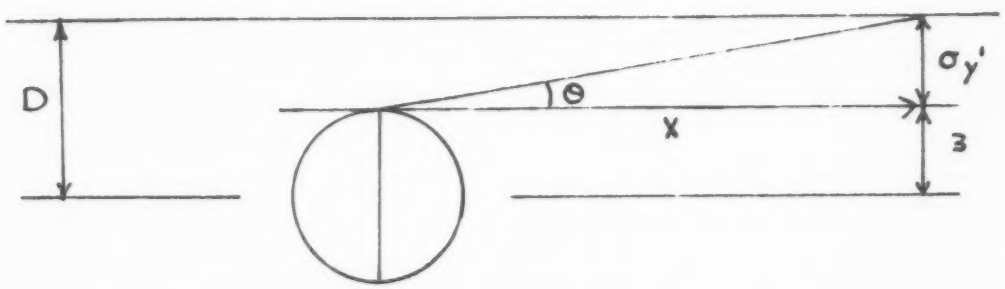
$$\sigma_y' = .16X\ (1 + .0004X)^{-.5}$$

In the Pasquill system of categorizing atmospheric stability, category 'D' is a neutral condition indicating a well mixed atmosphere. 'D' stability was chosen because the highest downwind concentrations resulting from construction emissions will probably occur during periods of 'D' stability.

In Tables A2-1 through A2-4 concentrations of construction emissions at various distances (D) from construction have been expressed as a percentage of concentrations at the source. These concentrations are indicated for winds blowing perpendicular to (90°), parallel to (0°) and at 45° to the segment orientation.

At a distance D from construction, the distance X downwind, required to calculate σ_y', varies with wind direction. For winds blowing perpendicular to the segment orientation X = D.

For winds blowing parallel to the segment orientation:



$$X = \frac{\sigma_y'}{\text{Tan } \Theta}$$

$$= \frac{D - 3}{\text{Tan } \Theta}$$

approximating $\Theta = 9°$

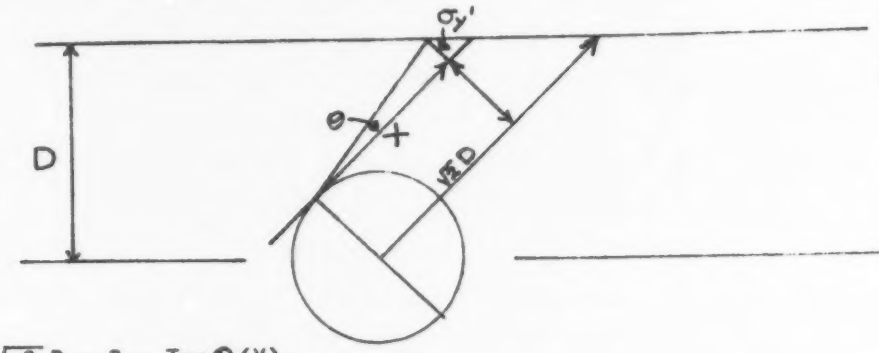
$$X = 6.31 (D - 3)$$

Where: $$X = \frac{D - 3}{\text{Tan } \Theta} \leq D$$

Use X = D

Approximating $\Theta = 9°$, the distance at which X = D is 3.56 m.

For winds blowing at 45° to the segment orientation:



$$X = \sqrt{2}\,D - 3 - \text{Tan}\Theta(X)$$

$$X = \frac{\sqrt{2}\,D - 3}{1 + \text{Tan}\,\Theta}$$

approximating $\Theta = 9°$

$$X = 0.86\,(\sqrt{2}\,D - 3)$$

Where: $$X = \frac{\sqrt{2}\,D - 3}{1 + \text{Tan}\,\Theta} \leq D$$

Use X = D

Approximating $\Theta = 9°$, the distance at which X = D is 11.73 m.

The approximation $\Theta = 9°$ is derived as follows:

$$\text{Tan}\,\Theta = \frac{\sigma'_y}{X}$$

$$\sigma'_y = .16\,X\,(1 + .0004\,X)^{-.5}$$
$$\sigma'_y = .16\,X$$

For $\text{Tan}\,\Theta = \sigma'_y$
$= .16$
$\Theta = 9.09°$
$\sim 9°$

Also shown in Tables A2-1 through A2-4, for various distances from construction, is the frequency with which concentrations of construction emissions exceed 50%, 25% and 10% of the source concentration. These frequencies have been calculated on the basis of frequency of occurrence of winds from various directions.

The wind rose presented in Figure A2-1 is based on data collected at the Hamilton Marine Police and Royal Botanical Gardens weather stations (Environment Canada, 1975). For the purposes of this analysis it has been assumed that data collected at these stations is generally representative of conditions in Hamilton and that most construction activities will be carried out during the months of April through October.

TABLE A2-1: DOWNWIND CONCENTRATIONS OF CONSTRUCTION EMISSIONS AS A PERCENTAGE OF THE SOURCE CONCENTRATION UNDER D STABILITY CLIMATIC CONDITIONS: EAST SIDE OF NORTH-SOUTH SEGMENTS.

DISTANCE FROM CONSTRUCTION (D) - m	WIND DIRECTION WITH RESPECT TO SEGMENT ORIENTATION			% OF TIME DOWNWIND CONCENTRATION EXCEEDS X % OF SOURCE CONCENTRATION		
	90°	45°	0°	X = 50%	X = 25%	X = 10%
2	90%	90%	90%	71%	71%	71%
4	82%	82%	75%	71%	71%	71%
6	76%	76%	50%	71%	71%	71%
8	70%	70%	37%	62%	71%	71%
10	65%	65%	30%	62%	71%	71%
15	56%	55%	20%	62%	62%	71%
20	48%	46%	15%	0%	62%	71%
30	38%	36%	10%	0%	62%	71%
40	32%	29%	8%	0%	62%	62%
50	27%	25%	6%	0%	62%	62%
75	20%	18%	4%	0%	0%	62%
100	16%	14%	3%	0%	0%	62%
125	13%	11%	3%	0%	0%	62%
150	11%	10%	2%	0%	0%	26%
175	10%	8%	2%	0%	0%	26%
200	9%	8%	2%	0%	0%	0%

TABLE A2-2: DOWNWIND CONCENTRATIONS OF CONSTRUCTION EMISSIONS AS A PERCENTAGE OF THE SOURCE CONCENTRATION UNDER D STABILITY CLIMATIC CONDITIONS: WEST SIDE OF NORTH-SOUTH SEGMENTS.

DISTANCE FROM CONSTRUCTION (D) - m	WIND DIRECTION WITH RESPECT TO SEGMENT ORIENTATION			% OF TIME DOWNWIND CONCENTRATION EXCEEDS X % OF SOURCE CONCENTRATION		
	90°	45°	0°	X = 50%	X = 25%	X = 10%
2	90%	90%	90%	40%	40%	40%
4	82%	82%	75%	40%	40%	40%
6	76%	76%	50%	40%	40%	40%
8	70%	70%	37%	31%	40%	40%
10	65%	65%	30%	31%	40%	40%
15	56%	55%	20%	31%	31%	40%
20	48%	46%	15%	0%	31%	40%
30	38%	36%	10%	0%	31%	40%
40	32%	29%	8%	0%	31%	31%
50	27%	25%	6%	0%	31%	31%
75	20%	18%	4%	0%	0%	31%
100	16%	14%	3%	0%	0%	31%
125	13%	11%	3%	0%	0%	31%
150	11%	10%	2%	0%	0%	31%
175	10%	8%	2%	0%	0%	11%
200	9%	8%	2%	0%	0%	0%

TABLE A2-3: DOWNWIND CONCENTRATIONS OF CONSTRUCTION EMISSIONS AS A PERCENTAGE OF THE SOURCE CONCENTRATION UNDER D STABILITY CLIMATIC CONDITIONS: NORTH SIDE OF EAST-WEST SEGMENTS.

DISTANCE FROM CONSTRUCTION (D) - m	WIND DIRECTION WITH RESPECT TO SEGMENT ORIENTATION			% OF TIME DOWNWIND CONCENTRATION EXCEEDS X % OF SOURCE CONCENTRATION		
	90°	45°	0°	X = 50%	X = 25%	X = 10%
2	90%	90%	90%	69%	69%	69%
4	82%	82%	75%	69%	69%	69%
6	76%	76%	50%	69%	69%	69%
8	70%	70%	37%	32%	69%	69%
10	65%	65%	30%	32%	69%	69%
15	56%	55%	20%	32%	32%	69%
20	48%	46%	15%	0%	32%	69%
30	38%	36%	10%	0%	32%	69%
40	32%	29%	8%	0%	32%	32%
50	27%	25%	6%	0%	32%	32%
75	20%	18%	4%	0%	0%	32%
100	16%	14%	3%	0%	0%	32%
125	13%	11%	3%	0%	0%	32%
150	11%	10%	2%	0%	0%	32%
175	10%	8%	2%	0%	0%	3%
200	9%	8%	2%	0%	0%	0%

TABLE A2-4: DOWNWIND CONCENTRATIONS OF CONSTRUCTION EMISSIONS AS A PERCENTAGE OF THE SOURCE CONCENTRATION UNDER D STABILITY CLIMATIC CONDITIONS: SOUTH SIDE OF EAST-WEST SEGMENTS.

DISTANCE FROM CONSTRUCTION (D) - m	WIND DIRECTION WITH RESPECT TO SEGMENT ORIENTATION			% OF TIME DOWNWIND CONCENTRATION EXCEEDS X % OF SOURCE CONCENTRATION		
	90°	45°	0°	X = 50%	X = 25%	X = 10%
2	90%	90%	90%	70%	70%	70%
4	82%	82%	75%	70%	70%	70%
6	76%	76%	50%	70%	70%	70%
8	70%	70%	37%	33%	70%	70%
10	65%	65%	30%	33%	70%	70%
15	56%	55%	20%	33%	33%	70%
20	48%	46%	15%	0%	33%	70%
30	38%	36%	10%	0%	33%	70%
40	32%	29%	8%	0%	33%	33%
50	27%	25%	6%	0%	33%	33%
75	20%	18%	4%	0%	0%	33%
100	16%	14%	3%	0%	0%	33%
125	13%	11%	3%	0%	0%	33%
150	11%	10%	2%	0%	0%	33%
175	10%	8%	2%	0%	0%	6%
200	9%	8%	2%	0%	0%	0%

Hamilton Wind Rose Adapted from Data Collected at Marine Police and Royal Botanical Gardens Weather Stations; April-October, 1955-1972. (Environment Canada, 1975)

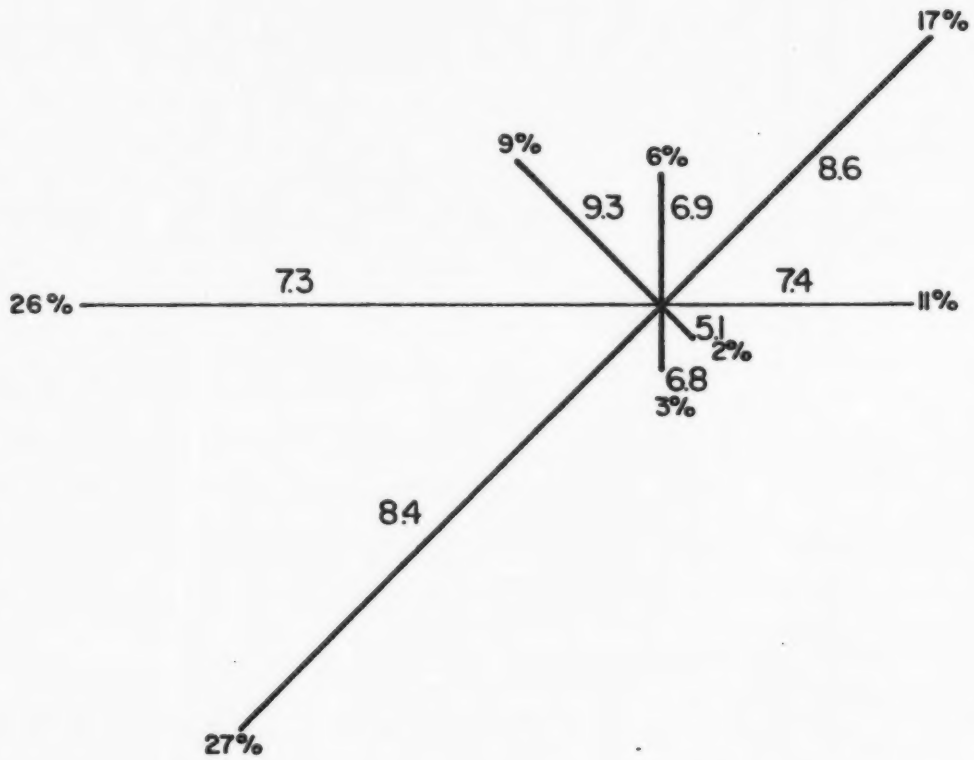


Figure A2.1

APPENDIX 8

IMPACTS OF CONSTRUCTION PROCESS

(Source - the Functional Plan)

CONSTRUCTION PROCESS - SECTION 1-MOUNTAIN

No.	Item of Work	Description of Activity	Working Days	Site Impact	Mitigative Measures
1	Preparation	Shop drawing approvals		None	None required
2	Mobilization	Set up equipment		None	None required
		Fabrication of steel box beams & columns complete with temporary bracing and sound damping		None	None required
3	Foundations	Locate underground service crossings and relocate as required	1-4	Two-lane width occupied at each column location. Noise. Some dust.	Traffic barriers. Flagmen during all activity for vehicular and pedestrian control.
		Clear site and excavate for foundation	2-4	Excavating and drilling equipment, concrete and dump trucks infrequently.	Activity limited to normal working hours.
		Expose, support or relocate underground services	1-2		Noise reduction equipment used where possible.
		Install caissons	2-5		Frequent mud cleanup.
		Form, pour and strip footing	4-6		Alternate routes provided.
		Backfill all excavations	1	Left turns restricted.	
4	Transportation of fabricated units or materials	Load, ship and unload columns with crossheads, box beams and precast deck slabs		Large delivery trucks and crane to unload	Normal H.T.A. restrictions.
5	Guideway construction	Erect column with crosshead and grout base plate	1	Crane for erection. Concrete mixer delivery.	See 3 above.
		Fill column with concrete	1	Bolting.	
		Erect and splice beams	1		
		Install deck slab and sidewalls	1		
6	Restoration	Granular base, concrete and asphalt work to restore to original condition.	2-5	Trucks, loaders, vibrator, mixers, rollers.	See 3 above.

CONSTRUCTION PROCESS - SECTION 2-CUT AND COVER

No.	Item of Work	Description of Activity	Working Days	Site Impact	Mitigative Measures
1	Locate all existing utilities	Survey crew			
	Twin sewers and relocate watermain	Cut pavement and excavate	2-3	Two lanes closed or one lane open & sidewalk	Traffic barriers. Flagmen during all activities for vehicular and pedestrian control.
		Install pipes and connect to existing main and services	2-3	Noise, dust, mud and trucks	
		Backfill	1	Access to property disrupted	Activities limited to normal working hours.
		Surface restoration	1	Disruption to services (2-3 hrs)	Noise reduction equipment used where possible.
					Frequent mud cleanup.
2	Installation of soldier piles	Auger 500 mm holes to bedrock	1-2 (50')	One lane closed at drilling operation Drilling equipment (truck mounted) Trucks Front end loader Noise, dust, mud	Same as 1, above
		Place steel soldier pile in holes and fill with lean concrete	1-2	Trucks (steel delivery) Light crane Concrete truck	Same as 1, above
3	Excavation (1st lift)	Close road to traffic over tunnel		Mobile pneumatic concrete breaker	Same as 1, above
		Break up concrete pavement	5-8 (300')	Bulldozer, trucks	Continuous notification to public, police, fire dept. etc. re construction schedule.
		Excavate to 5' and place lagging		Severe noise Dust and mud Traffic restricted	Widen existing road to provide detour by construction site.
4	Install temporary decking	Erect steel beams between soldier piles and brace	5-8 (300')	Light cranes Trucks Air compressor Noise of impact wrench	Same as 1, above
		Install timber decking (12"x12")			
		Open traffic			

CONSTRUCTION PROCESS - SECTION 2- CUT AND COVER

No.	Item of Work	Description of Activity	Working Days	Site Impact	Mitigative Measures
5	Excavation (2nd lift)	Excavate to rock underneath decking and install timber lagging	8-12 (300')	Hauling from ramp area (south portal only) Trucks on road system Noise Restricted speed limit on decked area	Same as 1, above
6	Excavation (rock)	Drill and blast rock to invert level	8-12 (300')	Temporary disruption to traffic during blasting Noise and vibration in adjacent residences Hauling from ramp area only	Same as 1, above Continuous notification to public re construction schedule
7	Construct box section of tunnel	Install drain and manholes Install form work and reinforce steel and concrete for invert walls and roof Remove form work and waterproof roof of structure	15-20 (300')	Temporary disruption to traffic when construction materials and concrete are supplied to work area through the decking.	Same as 1, above
8	Surface restoration	Close traffic over box section Remove decking and steel beams Backfill over structure Pave road and restore sidewalks, etc. Open traffic	8-10	Cranes, trucks, air compressor Bulldozer, rollers Pavers, concrete trucks Traffic restricted Noise and mud	Same as 1, above

CONSTRUCTION PROCESS - SECTION 3 - TUNNEL

No.	Item of Work	Description of Activity	Working Days	Site Impact	Mitigative Measures
1	Job Planning	Plan construction Order Tunnel Boring Machine Design material handling equipment	30-90	None	None
2	Mobilization	Organize work yard Install power supply Clear site at portal	20-30	Trucks Front end loader Noise and dust Fence in area of work yard	Traffic barriers. Flagmen during all activities for vehicular and pedestrian control. Activities limited to normal working hours. Noise reduction equipment used where possible. Frequent mud cleanup.
3	Construct Portal	Clearing and grubbing Excavate to rock face Prepare area for Tunnel Boring Machine	15-20	Noise, dust, trucks Bull dozer	
4	Install Tunnel Boring Machine	Receive and set up Tunnel Boring Machine	15-20	Trucks and equipment delivered	
5	Excavate Tunnel	Operate T.B.M. 2 shifts/day Set up material handling equipment as tunnel is advanced Install temporary light drainage and ventilation to face tunnel Store material in yard for haulage in normal work hours Install rock anchors as required	120-160	Some vibration noise may be detected in residence near tunnel Most activity only perceived at portal and work yard Trucks on roads	Haulage confined to normal working hours
6	Liner Installation	Deliver precast liner segments Move to work area and install by special equipment Grout behind liner segments	140-200	Delivery trucks	
7	Slab Installation	Cast in place slab and curb Install precast isolation slab	100-120	Delivery trucks	

CONSTRUCTION PROCESS - SECTION 4-DOWNTOWN

No.	Item of Work	Description of Activity	Working Days	Site Impact	Mitigative Measures
1	Preparation	Shop drawing approvals		None	None required
2	Mobilization	Fabrication of formwork		None	None required
		Precasting of columns and beams		None	None required
3	Relocate watermain, sewer or buried utility cable (where necessary)	Cut pavement, excavate and install pipe/ducts	3-5	Two lane width or one lane and sidewalk occupied. Trucks, excavator, crane.	Traffic barriers. Flagmen during all activity for vehicular and pedestrian control.
		Connect to existing main & services and backfill	2	Noise, mud.	Activity limited to normal working hours. Noise reduction equipment used where possible. Frequent mud cleanup.
				Some disruption to service.	Temporary service provided where possible.
		ABOVE PROCESS MAY BE REPEATED MORE THAN ONCE			
	Trolley Bus wire & street lights (where necessary)	Dismantle	1	Trolley buses must be short turned. No street lights;or on one side of street only	Shuttle diesel bus service. Temporary lighting provided if necessary.
4	Foundations	Locate underground service crossings & relocate as required	1-4	Two lane width occupied at each column location. Noise. Some dust.	Same as 3, above
		Clear site and excavate for foundations	2-4	Excavating and piling equipment, concrete and dump trucks infrequently.	
		Drive piles and fill with concrete	2-5		
		Form, pour and strip footing	4-6	Some traffic restrictions.	Alternate routes provided.
5	Transportation and erection of precast units or materials	Ship and erect column and grout	1	Crew, one 30 ton crane and concrete truck	Same as 3, above
		Let grout set	7		
		Ship and erect precast beams	1	Crews, two cranes	
		Form and pour closure, crosshead and side walls	2	Crew, compressor, concrete truck and small crane	
		Let concrete cure	7	Crew and equipment, small gas operated pump, truck	
		Post tension and grout, remove shoring	2		

CONSTRUCTION PROCESS - SECTION 4-DOWNTOWN

No.	Item of Work	Description of Activity	Working Days	Site Impact	Mitigative Measures
6	Restoration	Replace trolley and other aerial wires.	1-2	Temporary traffic restriction	
		Granular base, concrete and asphalt work to restore street to original condition.	2-5	Trucks, loaders, vibrator, mixers, rollers.	Same as 3, above